WICK STRUCTURE OF HEAT PIPE

BACKGROUND OF THE INVENTION

The present invention relates in general to a wick structure of a heat pipe, and more particularly, to a wick structure fabricated by a process during which the peeling and fracture tendency of the wick structure is eliminated, while the heat absorption and the conduction of the wick structure is greatly enhanced.

Figures 1 and 2 illustrate a conventional wick structure of a heat pipe. Figure 1 shows a heat pipe having a tubular member 10a and a screen mesh 20a, and Figure 2 shows a heat pipe including a sintered heat pipe having the tubular member 10a and a sintered material 30a. The wick structure formed of the mesh 20a and the sintered material 30a serves as a medium for liquid flow induction. The mesh-type heat pipe winds the screen mesh 20a around an axial rod to be inserted into the tubular member 10a. When screen mesh 20a is attached to the internal wall of the tubular member 10a be the insertion of the axial rod, the axial rod is removed from the tubular member 10a to form the mesh-type heat pipe. The sinter-type heat pipe uses an axial rod 31a inserted into the tubular member 10a. Powder-like sintered material 30a is then poured into the tubular member 10a. The tubular member 10a is cooled down after sintering process, and the axial rod 31a is removed from the tubular member 10a to form a sinter-type heat pipe. In application, the heat pipes are configured according to specific structures of heat dissipation devices or heat sources. For example, the heat pipes may be configured with an L shape or a U shape, or configured into a flat tube or a tube having higher section and lower section, such that the heat pipes can be properly connected to the heat dissipation fins or heat source.

However, the above heat pipe wick structure suffers from the following disadvantages during fabrication or mechanical processes.

Firstly, the tubular member 10a and the screen mesh 20a are fabricated from different types of materials. When the heat pipe is forced to bend, the corners of the screen mesh 20a are stretched to reduce the structure density thereof. The screen mesh 20a may also peel from the internal wall of the tubular member 10a during the bending process. Thereby, the capillary force of the screen mesh 20a is reduced.

Secondly, the bending step frequently causes fracture of the sintered material 30a. In addition, as the axial rod 31a has to be inserted into and removed from one end of the tubular member 10a, the insertion and removal of the axial rod 31a inevitably removes a portion of the sintered material 30a. Further, as the removal step is performed after the tubular member 10 is softened by an annealing process, the tubular member 10a is easily deformed by the removal process.

Thirdly, it is not easy to position the axial rod 31a at the axis of the tubular member 10a during thermal fusion or condensation, such that uneven thickness of the wick structure is resulted.

Fourthly, when a heat pipe with a large gauge is fabricated, the volume and mass of the axial rod 31a are consequently increased. Therefore, longer time is consumed for heating and cooling to cause more variations of the wick structure.

To resolve the problems caused by the conventional heat pipe as described above, with many years of experience in this field, a wick structure of a heat pipe has been developed as described as follows.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a wick structure of a heat pipe. A composite structure is formed to prevent the wick structure from being peeling or fractured during mechanical process performed on the heat pipe. Thereby, the heat absorption and conduction capability of the heat pipe is enhanced. Further, the axial

rod used in sintering is not required any more. Therefore, the fabrication process is simplified, and the cost is reduced.

The wick structure provided by the present invention includes a wick structure attached to an internal wall of a tubular member. The tubular member is preferably fabricated from metal material with good conducting performance, and the wick structure includes a mesh member and a plurality of particulate members. The mesh member is in the form of an elongate circular ring attached to the internal wall of the tubular member, and the particulate members are embedded in the interstices of the mesh member. The wick structure is attached to the internal wall by sintering, such that a dense wick structure is formed.

These and other objectives of the present invention will become obvious to those of ordinary skill in the art after reading the following detailed description of preferred embodiments.

It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

These as well as other features of the present invention will become more apparent upon reference to the drawings therein:

Figure 1 shows a conventional heat pipe;

Figure 2 shows another type of conventional heat pipe;

Figure 3 shows a cross sectional view of a heat pipe in one embodiment of the present invention;

Figure 4 shows a local enlargement of Figure 3; and

Figure 5 shows a cross sectional view of a heat pipe in another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

Referring now to the drawings wherein the showings are for purpose of illustrating preferred embodiments of the present invention only, and not for purposes of limiting the same, Figure 3 and Figure 4 show a heat pipe in one embodiment of the present invention. As shown, the heat pipe includes a tubular member 10 and a wick structure 20.

The tubular member 10 is preferably fabricated from material such as copper that has good conducting characteristics. The tubular member 10 may be formed with various geometric cross sections. In this embodiment, the tubular member 10 has a circular cross section. The tubular member 10 has an open end 11, a close end 12, and an internal wall 13.

The wick structure 20 has a fusion (melting) point lower than that of the tubular member 10 to advantage the sintering process performed on the wick structure 20. The wick structure 20 comprises a mesh 21 and a plurality of particulate members 22. The mesh 21 includes a woven mesh, porous thin plate or thin film with a plurality of porosities and an uneven surface with a plurality of recesses and protrusions. In this embodiment, the mesh 21 includes a woven mesh having a circular ring cross section. The perimeter of the woven mesh is slightly larger than an internal perimeter of the tubular member 10, such that mesh 21 can be firmly attached to the internal wall 13 of the tubular member 10. One end (front end) of the mesh 21 extends towards a bottom surface of the close end 12 of the tubular member 10 to improve the thermal conduction of the tubular member 10. The particulate members 22 include metal powders or fine broken fibers. In this

embodiment, metal powders are used as the particulate members 22. The dimensions of the particulate members 22 are substantially smaller than the dimensions of the interstices of the mesh 21, such that the particulate members 22 can be embedded in the interstices of the mesh 21. The fusion point of the particulate members 22 is lower than that of the mesh 21, such that the particulates members 22 can be easily embedded in the mesh 21 during the sintering process, and a dense wick structure can be formed.

To attach the wick structure 20 to the tubular member 10, the mesh 21 is inserted in the tubular member 10 from the open end 12 thereof. The particulate members 22 are then poured into the tubular member 10. The tubular member 10 is then evenly rotated to evenly distribute the particulate members 22 in the mesh 21. A sintering process is performed to attach the particulate members 22 and the mesh 21 to the internal wall 13 of the tubular member 10.

Figure 5 shows a cross sectional view of a heat pipe in another embodiment of the present invention. In this embodiment, a support member 14 is disposed in the tubular member 10 after the wick structure 20 is formed in the tubular member 10. The support member 14 has a fusion point higher than that of the mesh 21 and the particulate members 22. The support member 14 can be in the form of a linear or plate spiral structure or an elastic plate curled as a roll. By the elastic force exerted from itself, the mesh 21 and the particulate members 22 are pressed against the internal wall 13 of the tubular member 10. Therefore, the mesh 21 will not shrink or curl during sintering process, and the wick structure 20 can be firmly attached to the internal wall 13.

Accordingly, the present invention has at least the following advantages:

The composite wick structure prevents the wick structure from peeling or being fractured during sintering or mechanical process.

The mesh and the particulate members are attached to the tubular member by sintering, such that the wick structure can be fabricated from composite materials. Therefore, there are more choices and less limitation in design and fabrication.

During the fabrication process, the axial rod used for the conventional heat pipe is not required. Therefore, the cost is reduced, and the quality is improved. In addition, the uneven thickness of the wick structure is avoided.

This disclosure provides exemplary embodiments of wick structure of a heat pipe. The scope of this disclosure is not limited by these exemplary embodiments. Numerous variations, whether explicitly provided for by the specification or implied by the specification, such as variations in shape, structure, dimension, type of material or manufacturing process may be implemented by one of skill in the art in view of this disclosure.